Yanbu Industrial College

Department of Electrical Power Engineering Technology

EEET 103 Electrical Machines I

Lab Exercise No. 09

Title **LOAD CHARACTERISTICS OF SELF EXCITED DC GENERATOR**

Student Name: _____ **Student ID:** _____

Submission Date: _____ **Lab Section:** _____

Important Notes

1. Every student must write Name, Section, and Lab exercise No, Title, ID Number and Submission Date clearly in provided space.
2. Only neat, clean and hand written reports on this prescribed format given in E-learning will be accepted.
3. Students are encouraged to work and study together as team work is highly recommended.
4. No credit will be given for works that are copied from any source.
5. Assignments and reports must be turned in on time.
6. Please make photocopy of your lab report before submission as original may not be returned to you.
7. In case of late submission 20% of total credits will be reduced per day.

For Instructor's use only.	
Date Received	
Maximum Marks	**10**
Late By	**days**
Deductions	**%**
Marks Obtained	
Comments (If any)	

Signature: _____

LOAD CHARACTERISTICS OF SELF EXCITED DC GENERATOR

PERFORMANCE OBJECTIVES:

Upon completion of this laboratory experiment, the student will be able to:

- Perform load tests on generators and compute voltage regulation.
- Explain the behaviour of a self-excited DC generator.

EQUIPMENT:

1. DM-100 DC Machine.
2. DYN-100 Dynamometer.
3. 0-125 volt Hampden variable DC power supply, 5 amps.
4. 0-150 volt Hampden variable DC power supply, 1 amp.
5. Two Hampden DC Voltmeters.
6. Two Hampden DC Ammeters.
7. Tachometer.
8. RL – 100 A resistance bank.

DISCUSSION:

A separately-excited DC generator must be supplied field current from a separate power source. A self-excited generator, on the other hand, uses some of its own generated power to excite the field.

In DC shunt generators, the residual magnetism in the field poles begins the generation process. Then, when current begins flowing in the field coil the voltage builds up, under no load, to rated voltage.

When the DC shunt generator is loaded, its terminal voltage drops, just like it did for the separately-excited generator. But this voltage is also applied across the shunt field coil. Hence the reduction of voltage also causes a reduction in field current, and field flux, leading to a further reduction in terminal voltage. We may thus expect that loading a self-excited generator causes its voltage to drop by a greater amount than for a separately-excited generator.

$$\%\text{Voltage Regulation, } \mathbf{VR} = \frac{V_{NL} - V_{FL}}{V_{FL}} X100$$

Where V_{FL} = Terminal voltage with rated load applied
V_{NL}= Terminal voltage at no load

CAUTION!

1. **High voltages are present in this experiment. Do not make any connections with the power on. The power should be turned off after completing measurement**

CIRCUIT CONNECTIONS:

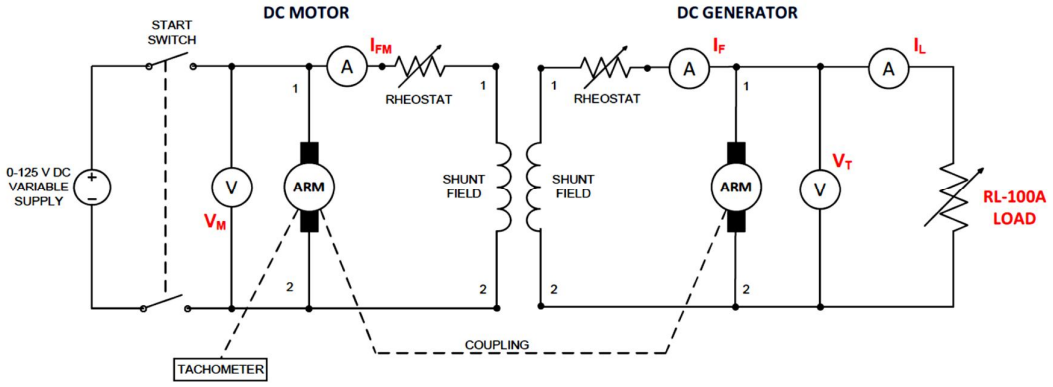


Figure 1.1

PROCEDURE:

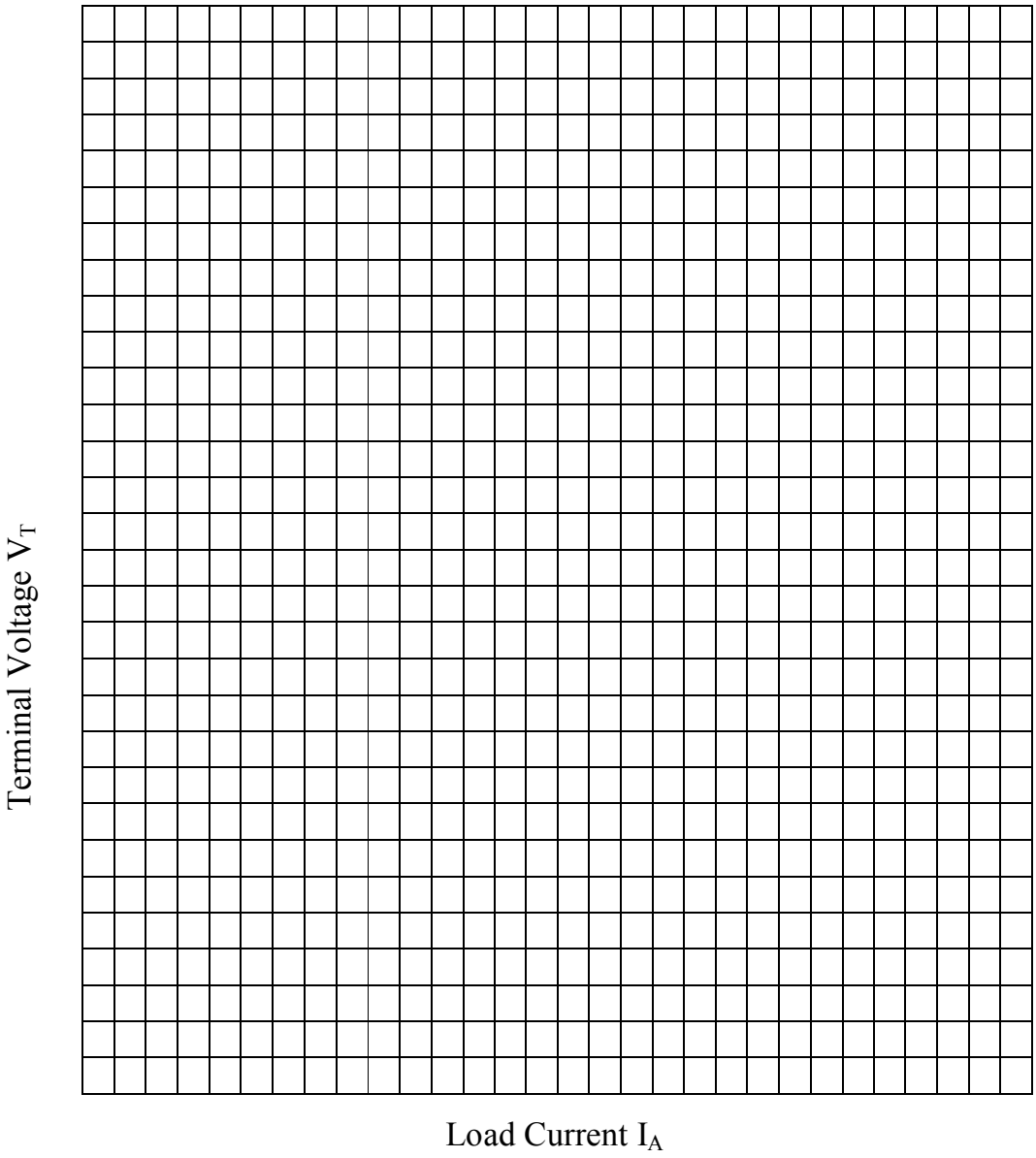
1. Make the motor connections shown in Figure 1.1 but do not turn the power ON yet. Turn the knob of the 0-125 variable DC supply fully counter clockwise to its zero position. Turn the motor's field rheostat knob fully counter clockwise to its minimum resistance position.
2. Make the generator connections shown in Figure 1.1. Turn the generator's field rheostat knob fully clockwise to its maximum resistance position. Turn the knob of the 0-150 volt supply fully counter clockwise to its zero position.
3. Have someone check your connections to be sure they are correct. Then turn ON the main AC, the 0-150 volt DC, the 0-125 volt DC, and the motor circuit breakers.
4. Slowly turn the knob of the 125 volt supply fully clockwise to its maximum output position. The motor should now be running.
5. With the tachometer directed at the motor shaft, turn the motor's field rheostat knob clockwise until the motor is rotating at 1800 rpm.
6. Push all of the toggle switches on the RL-100-A Resistance Load Bank to the downward (OFF) position. This is the "**No Load**" condition.
7. Slowly increase the output of the 0-150 volt DC supply to 125 volts.
8. Turn the generator's field rheostat knob counter clockwise until the generator terminal voltage is 130 volts.
9. Recheck the speed and make any adjustment necessary to the motor's field rheostat knob to bring the motor back to 1800 rpm.
10. Read the field current $\mathbf{I_F}$, the armature (load) current $\mathbf{I_A}$, and the terminal voltage $\mathbf{V_T}$ of the generator. Record these values in table of OBSERVATIONS.
11. On the RL-100A Resistance Load Bank, push the toggle switch No. 1 upward.
12. Repeat Steps 9 and 10.
13. Repeat Steps 9 and 10 for different values of the load resistance given in the observation table.
14. Turn OFF all circuit breaker switches. Disconnect all leads.

OBSERVATIONS:

Resistance Switch Positions	Field Current I_F	Load Current I_A	Output Voltage V_T	Load Power P_L
No Load				
Step 1				
Step 2				
Step 3				
Step 4				
Step 5				
Step 6				
Step 7				
Step 8				
Step 9				
Step 10				
Step 11				

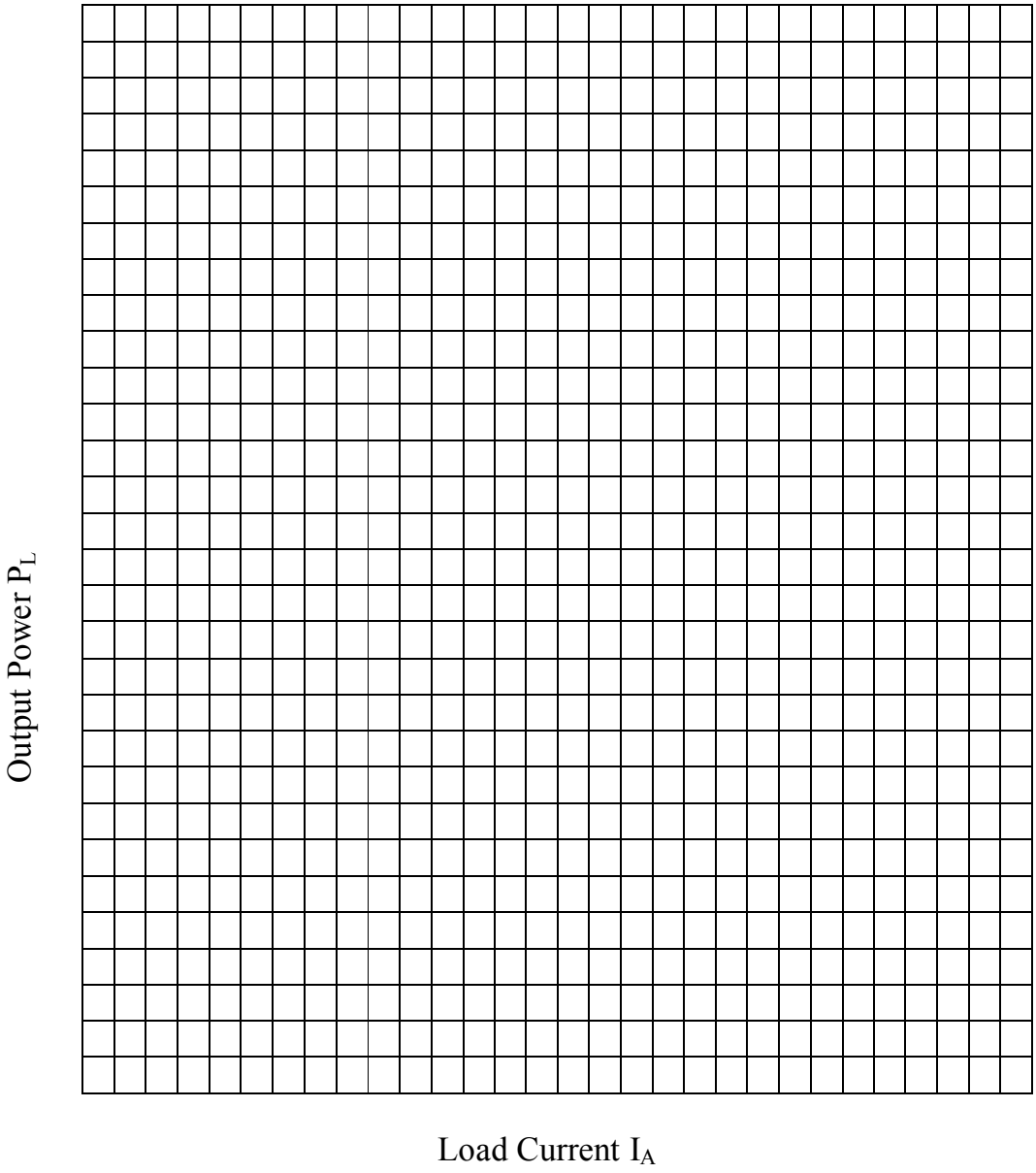
GRAPH 01:

Plot the $\mathbf{V_T}$ varies with the Armature current $\mathbf{I_A}$ for a separately excited generator



GRAPH 02:

Plot the output power $\mathbf{P_L}$ and load current $\mathbf{I_A}$ Characteristics of the separately excited generator.



REPORT

Prepare a report containing:

1. Diagrams of each circuit.
2. All tables.
3. Graph on a grid paper.
4. All calculations and required data.
5. Answers to questions.

REVIEW QUESTIONS

1. Field excitation current in a self-excited generator:

	a	Goes up as the load increases.
	b	Goes down as the load increases
	c	Stays the same as the load increases

2. The terminal voltage of a self-excited generator

	a	Goes up as load increases
	b	Goes down as load increases
	c	Stays the same as load increases

3. As load is applied to a self-excited generator:

	a	The field current is constant
	b	The terminal voltage is constant
	c	Neither field current nor terminal voltage is constant.

4. The current produced by the armature of a self-excited generator:

	a	Is the same as the load current?
	b	Divides, with part going to the field and part going to the load.
	c	Is the same as the field current?

5. The field coil in a self-excited generator:

	a	Gets current from the armature.
	b	Gets current from an outside power source.
	c	Doesn't need any current.

6. Did the terminal voltage increase or decrease when load current was increase on the self-excited generator?

7. For this self-excited generator did equal changes in load current in equal or unequal changes in terminal voltage?

Explain if this was expected and why?

8. Compute voltage regulation from the experimental data.

$$\%\text{Voltage Regulation, } \mathbf{VR} = \frac{V_{NL} - V_{FL}}{V_{FL}} X100$$

9. Would you consider a self-excited generator to have good regulation or poor regulation compared to separately-excited generator?

FINAL CHECKLIST

All the students must make sure, before they leave the Lab:

1. Turn the value of variable power supplies and resistive load to zero
2. Main power switch on the work bench is put "OFF".
3. All the connection of machines/ equipment is removed.
4. All machines/meters are properly placed (slide in) either in storage cabinet or in work station itself.
5. All connecting leads are sorted out according to their length and colours and placed on the hooks provided in the side of the work station.
6. Submit your answers to the questions, together with your data, calculations (if any) and results before the next laboratory sessions.